of Captain Evers, the islands of Raiatea and Borabora were completely devastated by the action of volcanoes.

At the end of the list of lava eruptions, Dr. Fuchs records the great mud eruption of one of the well-known mud volcanoes near Paternò in Sicily. After repeated shocks of earthquake in the province of Catania, spreading over two months, this eruption began on December 10, numerous craters ejecting streams of mud with great noise. Several of these craters were continuously active, as the mud was of little consistency, and freely permitted the ascending gases to escape. The others had explosions from time to time, as the crater basin was filled with much thicker mud, which prevented the gases from passing upwards until their tension was sufficiently high, and they ejected the mud in high rays. At the end of the year this mud eruption was still progressing with unabated force.

The number of earthquakes reported during 1878, amounts to 103. But amongst these there are many complete earthquake periods during which shocks and oscillations lasted with short intervals for hours, days, and even for several weeks in the same locality. If we would or could count all the separate shocks which occurred, a very high total would be reached. Thus in the comparatively unimportant earthquake of Zengg, twenty shocks were counted, and in the great earthquake of Terapaca, in the night of January 23, no less than forty shocks, while the oscillations lasted here almost without interruption until April 12. An earthquake on the island of Tanna (New Hebrides) lasted for four weeks, and in the province of Catania the oscillations succeeded each other almost without interruption from October 4 to November 19.

The earthquakes were most frequent in winter and autumn, thirty-nine occurring in winter, twenty-six in autumn, and nineteen each in summer and spring.

The most violent and most destructive of all these phenomena happened on January 23, in that district of Peru and Bolivia in which the terrible earthquake of 1868 took place. The province of Terapaca suffered more than any other. Here, with the earthquake of May 9, 1877, which in violence was hardly surpassed by that of 1868, a great and considerably extended period of frequently recurring oscillations had begun, amongst which the earthquake of January 23, 1878, was prominent by its particular force. At Iquique it began at 7.55 P.M., and the shocks continued during the whole night. As usual, the subsequent tidal wave did still greater damage than the earthquake itself, and this was particularly the case at Arequipa, Pica, Mantilla, Pisaqua, Arica, and Terapaca.

The earthquake on October 2, in the southern part of the republic of San Salvador, was also very violent. In the town of Incuapa almost all the houses were destroyed, and many of the inhabitants perished. In the vicinity a number of villages disappeared entirely. The motion of the soil was first undulatory and ended with a terrible shock.

Of European earthquakes the following must be mentioned specially:

On January 28, about noon, an earthquake shook the north-western part of France and the south of England. It was particularly distinct in Normandy, at Rouen, Havre, and Dieppe. Even in Paris the shock was so considerable that several houses were endangered. In England it occurred between 11:45 and 10:50 A. M., and was observed at Greenwich, London, Brighton, Southampton, Cowes, and several other places.

Repeatedly shocks were felt in north-western Switzerland and at the south-west corner of the Black Forest. The first and more marked phenomenon happened on January 16, and consisted of several shocks separated by short intervals. These shocks were noticed at Basel, Brugg, Solothurn, on the Swiss side of the Rhine, and at Lörrach, Schopfheim, Waldshut, etc., on the Badish bank. They recurred at Basel on January 17, and on March 29 they were again felt in the whole area described, and then even at Freiburg and Strasburg.

Other instances of repeated earthquakes are:

Innsbruck (January 3, 10, 11, February 2, August 9).

Gross Gerau (January 2, March 25).

Lisbon (January 26, 27, June 8).

Piedmont (repeated shocks on November 25).

Constantinople, Ismid, and Brussa (continual shocks from 19 to end of May).

The damage done by the last mentioned phenomenon at Ismid and Brussa, on April 19, was very considerable; the little town of Esme was quite destroyed, and many inhabitants lost their lives. The English fleet, which happened to be anchored in the Bosphorus at the time, noticed the oscillations, and on board of one of the ships it was believed that the others were making torpedo experiments, and consequently looked out for shelter.

Less remarkable by its violence than by its enormous extent, considering its intensity, was the Low-Rhenish earthquake of August 26. The observations in this case were unusually exact and numerous, which gives additional interest to the occurrence. It began about 9 A.M., and was best observed in the city of Cologne. Here it consisted of an undulatory rising and sinking of the ground, which increased in intensity to such an extent that some buildings began to oscillate ominously. On the cathedral tower the smaller bell struck several times, and the wavering pillars in St. Gereon's Church caused such a panic among the congregation that all rushed out. In many parts of the city the walls of houses showed cracks. At the end of the oscillations a dull subterranean noise was heard and a second shock was observed by many persons.

In almost all localities in the Rhenish Province, from Cleve and Emmerich to Kyllburg, Ottweiler, and Montjoie the observations of the phenomenon were similar to those made at Cologne; the same was the case on the opposite bank of the Rhine, at Düsseldorf, Wiesbaden, Münster, and other places. At Aachen (Aix-la-Chapelle), five distinct shocks were noticed; at Elsdorf (on the Neuss-Düren Railway) no less than eighteen until the morning of August 27; and at Düren and Buir, their number was but little below this figure.

The area struck by the first shock, on August 26, at 9 A.M., may have measured over 2,000 geographical square miles, as its outlines may be indicated as follows: Arnsberg and Hanover in the north; Offenbach on the Main and Michelstadt in the Odenwald in the south-east; Strasburg, Paris, and Charelville in the south; Liége and Brussels in the west; and Utrecht in the north-west.

Prof. Klinkerfues has collected the most reliable observations of time and reduced them to the meridian of Paris. According to these calculations the earthquake happened at Cologne at 8h. 38·7m., at Strasburg at 8h. 39·9m., at Göttingen at 8h. 40·9m., at Hanover at 8h. 42·4m., and at Paris at 8h. 45·0m. If the starting point of the oscillations, according to number and intensity of the shocks, be supposed to have been situated about 2·5 geographical miles to the west of Cologne, the above indications of time give a velocity of the earthquake in the ground of 6·78 geographical miles, with a probable error of ± 0·48 mile. The depth of the original starting point is unknown. Prof. Klinkerfues is of opinion that it lay between 6·3 and 8·7 geographical miles from the surface. It is remarkable that the phenomenon was only noticed at the surface, and was all the more intense the higher the observer was above the ground. Many observations were made both at Cologne and at Hanover, which show that the oscillations were far more considerable in the upper stories of houses than in the lower ones. At Remagen the shock was so great on the upper floor of the school building that teachers and school children rushed terrified into the street, while on the ground floor the phenomenon was hardly noticed; the workmen on the towers of Cologne Cathedral saw the scaffolding oscillate to such an extent that they feared for their lives, and a water tank on the vault of the choir was almost entirely emptied. Yet not one of 1,100 miners working at a depth of 300 meters at Altessen noticed the least shock.

For a long time afterwards shocks occurred at Elsdorf and Buir. At the latter place they were observed on August 26, 27, 28, 29, September 2, October 24, December 3 and 10. Also in other places of the same area the shocks were repeated, so at Remagen (September 3), Wiesbaden (September 14), Osterrath and Crefeld (September 18), Cologne (December 10), Luxemburg and Namur (December 15).

With almost all earthquakes of slight intensity it is very difficult to determine to what class of earthquakes they belong. Thus in the Low-Rhenish earthquake no symptom points to any particular cause. We may surmise volcanic influence, because the most intense and most numerous shocks occurred near the north-western slope of the Eifel plateau; but with perhaps greater reason we may look for the cause of the phenomenon in the Rheno-Belgian coal district. Altogether the earthquake of August 26 seems to be but a link in a great earthquake period, which for some years past has been causing lasting changes in the coal deposits of that neighborhood. The names of Herzogenrath, Kohlscheid, Eschweiler, etc., recur in every one of Dr. Fuchs' yearly accounts, and apart from numerous weaker oscillations of small extent, considerable earthquakes occurred in this district from September 28 to November 12, 1873, and on June 24, 1877.—*Nature.*

THE BRONZE GATES OF BALAWAT.

Nine miles north-east of the cluster of rugged mounds and sandy ramparts which mark the site of the ancient Assyrian city of Calah, now known to the Arabs as the Mounds of Nimrud, there is situate a short distance from the bank of the Shor Derreh the long, low mound of Balawat, or "the Ruins." This mound has given its name to a small village of some 30 houses, which is situate a short distance to the south-west of the mound, and for this hamlet, with a part Mohammedan and part Christian population, the mound has formed the usual place of sepulcher; and it is owing to this that the fact of its containing treasures of the ancient Assyrian Empire was first discovered. During the digging of some graves on the site the workmen employed came upon a number of fragments of bronze plating, much broken and oxidized. Such fragments as were discovered being regarded as only relics of the infidels, trouble was fortunately not taken to search for more. The expeditions of Sir Henry Layard, Mr. George Smith, and others have taught the natives that there is a money value attached to these antiques by the Europeans, and so in course of time some of the bronze fragments, the largest of them not more than two feet in length, found their way to Mosul. Two of these fragments, and fortunately the best, found their way to the hands of Mr. Rassam, at that time in England, and were exhibited by him at a meeting of the Society of Biblical Archæology. By a fortunate chance, this first installment of the great brazen treasure of Balawat was extremely interesting, as when examined it was found to represent the payment of tribute to Shalmanesar III. (B.C. 859-825) by the maritime cities of Tyre and Sidon. No more fragments of the gates reached England until July of last year, when Mr. Rassam, who had always expressed a determination to have the remainder of the monument, brought to England with him, as the result of his expedition, two of the great brazen gates which for centuries had lain buried beneath the ruins of Balawat.

For a time the great plates of richly sculptured bronze, which are all that remain of the gates, were a great puzzle to the archæologists who examined them. The decay of the wood-work and the gradual accumulation of the earth above them had caused the bronze scrolls, which once had been straight and regular, to become loose from their framework and assume a most confused and bewildering shape. But the skilled knowledge of Mr. Ready, of the British Museum, through whose hands so many masses of metal have passed from unintelligible confusion to correct and beautiful restoration, soon solved the second problem, and it is to him archæologists owe the restoration of these splendid brazen gates. The bent, broken, and decaying mass of metal has gradually been straightened, joined, and cleaned, until at last—thanks to patient toil and study—we have restored to us one pair of the great temple gates. The inscriptions found in the south-eastern portion of the mound were those of the King Assur-nazir-pal, and by him the temple was erected. Those who first examined these monuments were unable to read the inscriptions which accompanied them on account of the thick coating of dirt and oxidation, and hence in the first instance these larger gates were attributed to him. But they, having now been cleaned, are found to have been erected by his son, Shalmanesar III. This does not preclude some of the other three pairs of which portions remain having been erected by the earlier monarch. Indeed, the mention of gates "plated with bronze," and the fact that the second and smaller pair brought to England by Mr. Rassam are illustrative of hunting expeditions, a pastime of which Assur-nazir-pal was passionately fond, seems to point to this smaller pair having been erected by him. The smaller pair are in an extremely decayed condition, and it is doubtful if they can be restored.

Now that the fragments which Mr. Rassam brought to England have been cleaned and arranged, it is not a difficult matter to restore the largest pair of the gates which have been recovered, and thus to gain a knowledge of these wonderful works of art which twenty-seven centuries ago, fresh from the hammer of the brazier, stood before the temple of the war god, Nergal. The solid iron cores which strengthened the massive cedarwood posts of these gates show them to have been more than 22 ft. in height, with wooden posts, themselves more than 12 in. in diameter. The wooden framework of these doors was entirely—posts, styles, and all—covered with plates of rich bronze containing more than 85 per cent. of copper The two leaves of the gate and the supporting posts give the width of the gateway to be 15 ft., so that there was presented to the view of the spectator on these huge portals more than 300 square feet of richly-worked bronze.

The decoration of the gates was by a series of long bronze ribbons or plates about 2 ft. in width and 8 ft. in length, which were laid horizontally on the wooden frame covering both the face and round of the post. Each of these scrolls was decorated by two tiers of sculptures in repoussé work, chased with a graving tool, illustrative of the campaign of Shalmanesar III. The tiers were separated from one another by a border decorated with rosettes, which were perforated to admit the nails fastening it to the frame. Each door was decorated with seven of these metal bands, making 14 in all. When we gaze at these splendid works of art, and build up before us these rich entrance gates to the temple of Shalmanesar (remarks a writer in the London *Times*, and his subsequent three-column description of them fully justifies the opinion expressed) we certainly must admit them to form one of the grandest historical monuments ever rescued from the grave of centuries.

EXPERIMENTAL GEOLOGY.

Geologists are popularly supposed to spend their time in examining the rocky masses which build up the earth's crust, in collecting and studying the relics of ancient life which lie entombed in many of these rocks, or in applying their knowledge to the construction of maps which mark out the distribution of the various rocks. And such, in truth, are the main lines of geological inquiry. Yet it would be wrong to forget that some of the knottiest problems in geology have been untied by men who have rarely wielded a hammer in the field, who have been utterly ignorant of organic remains, and who may never have laid down a single line upon a map. It was found, indeed, in the very infancy of the science, that the only chance of interpreting many of the phenomena which perplex the geologist was by calling in the aid of chemical and physical science. The prime object of geology is, of course, to reconstruct the past in the light of the present. But it is often impossible to guess how nature has been working in past ages in order to bring about the results which are now before our eyes, except by attempting to attain similar results by direct experiment in our laboratories. Observation in the field has naturally been the chief instrument in laying the foundations of geology; but observation finds a valuable auxiliary in experiment. There is unquestionably such a thing as experimental geology.

It is scarcely too much to say that experimental geology took birth in this country. At any rate, it is matter of history that some of the earliest and most important researches in this branch of the science were undertaken by Sir James Hall, of Dunglass, at once the disciple and the supporter of the famous Hutton. When, for instance, Hutton asserted that basalt had once been a molten rock, while his opponents ridiculed this assertion on the ground that such a substance, after being melted, would solidify into a glassy mass, it was Hall who silenced the cavil for a while by direct appeal to the crucible and the furnace. His experiments proved beyond contradiction that, under certain conditions of cooling, the molten mass might solidify as a stony substance, not to be distinguished from the original basaltic rock.

Since the days of Hall, geology has made considerable advance along the lines laid down by chemistry and physics; but the advance has been due not so much to workers in this country as to continental experimentalists. Among foreign chemical geologists, few have been more enthusiastic than the late Gustav Bischof, whose volumes are still our principal authority on the subjects to which they are devoted. While Germany has been represented by such men as Bischof, France has not been behind in the domain of experimental geology. Foremost among French experimentalists, who have successfully attacked geological problems is the accomplished director of the National *Ecole des Mines*. For thirty years M. Daubree has been working, more or less continuously, upon this track, and the results of his labors, collected and co-ordinate, have recently been given to the scientific world.*

Most of M. Daubree's researches, it must be confessed, are already familiar to the specialist. But to those who have not made a special study of experimental geology it may be well to refer to them, since they strikingly illustrate the manner in which experimental methods may be applied to the elucidation of geological questions. Any one who studies these investigations must admit that the chemist and the physicist, not less than the mineralogist and the biologist, have a fair right to be counted as fellow-workers with the geologist.

It is not pretended for a moment that the experimental geologist can imitate with anything like precision the conditions which occur in nature. Many of these conditions it is quite beyond his power to command in the laboratory. It was pointed out long ago by Sir James Hall that, in order to realize what goes on in the deep-seated portions of the earth, where mineral substances are subjected to the enormous weight of the overlying rocks, it is necessary to expose the substances on which we experiment to considerable pressure. The late M. Senarmont carried out some valuable experiments under pressure; and some of M. Daubree's most interesting results have been obtained under similar conditions. Such experiments are not undertaken without extreme difficulty, and even danger.

When water is very highly heated in closed vessels, the tension of the steam is often sufficiently great to tear open the strongest vessels as easily as though they were made of paper. Occasionally, however, the rupture is prevented, and results of singular interest are then obtained. Thus, M. Daubree has found that a piece of glass, which may be taken as the type of a complex silicate, after several days' exposure to the action of superheated water, is completely changed in character. The strong glass tubes in which the water was inclosed were found to be partly converted into definite hydrated silicates closely resembling some of the minerals called *zeolites*—minerals which occur not only in the cavities of eruptive rocks, but also in many mineral veins. It is notable, too, that in some of these experiments part of the glass was transformed into a crystallized anhydrous substance, identical with certain varieties of the common rock-forming mineral—*augite.* But the most curious result of the action of highly-heated water upon glass was the production of silica in a crystallized condition exactly like *quartz.* Quartz is one of the commonest of minerals; yet it is by no means easy in all cases to explain the conditions of its formation. The silica which we usually obtain in the laboratory assumes a gelatinous state, and dries up to a shapeless powder, utterly unlike the beautiful crystals which

---

* "Etudes Synthétiques de Géologie Experimentale." Par A. Daubrée. Première Partie: Application de la méthode expérimentale à l'étude de divers phénomènes géologiques. Paris: Dunod, 1879, 8vo, pp. 478.

© 1879 SCIENTIFIC AMERICAN, INC.

occur so abundantly in nature. But in M. Daubree's experiments under pressure, the quartz was artificially produced in crystals which in their minutest details closely mimic the natural mineral

It is true that the crystals of quartz thus produced are excessively small, but they are not a whit the less valuable on that account. The artificial crystal may be no bigger than a pin's head, yet if it possesses all the other characters of the native mineral, it is obviously as trustworthy a witness as to the genesis of the mineral as though it were a hundredfold the size. Had the forces which have been operating in the production of the microscopic crystals been allowed to act for a longer time, it is only fair to assume that they might have produced results of corresponding magnitude. Time is indeed one of the most important factors in the production of geological phenomena, and the shortness of human life places the experimental geologist at a manifest disadvantage. Yet if we are unable to carry on experiments in the laboratory for successive generations, we may occasionally avail ourselves of experiments in nature which are performed under conditions almost as clearly defined as those of the laboratory. Not the least interesting parts of M. Daubrée's volume are those in which he describes certain chemical changes that have been effected by thermal springs since the days of the Romans.

The ancient Romans, who were fully alive to the value of hot springs, appear to have paid considerable attention to the thermal waters which gush forth at Bourbonne-les-Bains, in the department of Haute-Marne. Roman masonry, based on piles, has been constructed around some of the springs, and above these Roman workings modern structures have been erected. Toward the end of 1874 some borings were carried through the deposits at the bottom of the old Roman baths, and from these deposits a large number of relics were obtained. The examination of a layer of mud brought to light no fewer than 4,700 Roman coins. Four of these were gold coins of Nero, Hadrian, Faustina junior, and Honorius; 265 were silver coins, principally of Imperial and Consular types, associated with a few Gaulish coins. Of bronze there were as many as 4,468—large, middle, and small brass—ranging over a considerable period. With the coins were associated other objects, such as statuettes, pins, and rings, in bronze, gold, lead, and iron. Now for sixteen centuries the mineral waters of these springs, the temperature of which is now between 58° and 68° Centigrade, have been uninterruptedly acting on these various metals, and the results are therefore equivalent to a series of laboratory experiments extending over this lengthened period. Hence we look with considerable curiosity to the kind of action which has taken place and to the nature of the resulting products.

Beneath the mud which contained the coins and other objects described above, there was a layer of conglomerate, formed of fragments of sandstone and grains of sand, cemented into a coherent mass. The agglutinating material consisted of mineral substances which had been slowly formed by the solvent action of the heated waters on the coins and other metallic objects. Careful examination of the products has brought out the interesting fact that many of them are identical with minerals which occur in veins, and that they are in many cases as beautifully crystallized as the natural products.

It is needless to cite a long catalogue of these recently formed minerals, but among the more characteristic the following may be named: *cuprite*, or red oxide of copper, occurring in octahedral crystals, and evidently an alteration-product of the bronze; *chalcosite*, or sulphide of copper, sharply crystallized in forms which resemble those from Redruth in Cornwall; *copper pyrites*, or yellow copper-ore, such as forms the staple mineral in most of our copper-lodes; *purple copper-ore*, better crystallized than most of the native mineral; and *gray copper-ore*, a rather rare substance, beautifully crystallized in tetrahedra, whence its name *tetrahedrite*. In some cases a single specimen from the old baths may contain all these copper-bearing minerals, just as a similar assemblage of species may be occasionally found by the miner in a copper vein.

Were it not that we are anxious to avoid mineralogical technicalities, it would be easy enough to extend this list. Thus, the old leaden pipes at the springs have yielded a crop of minerals similar to those which are obtained in lead veins, and including also some rare species, such as *phosgenite;* while the iron has, in like manner, been chemically acted upon, and yields *pyrites* and other ferruginous minerals. Even the masonry, the bricks and the concrete, which were used in the construction of the walls of the well, have yielded to the long continued action of the warm springs, and have given rise to certain silicates identical with native minerals.

Although the hot springs of Bourbonne-les-Bains offer, perhaps, the most striking known instance of chemical changes in historic times, it must not be supposed they are by any means an insolated case. Results of a like character were indeed obtained years ago by M. Daubree from the Roman workings at the hot springs of Plombières in France. It is obvious that the study of these comparatively recent changes tends to throw much light upon the origin of mineral veins or lodes—a subject which, in spite of all that has been written, is still enveloped in much mystery. Just as the student of palæontology requires an acquaintance with recent forms of life in order that he may interpret the structure of his fossils, so the study of these modern changes is of service in aiding us to understand the reactions which have gone on in past ages, and have resulted in the formation of vast mineral deposits. After all, it is but a glimpse of these changes that we are permitted to take. If such results as those described above have been produced by the action of water near to the surface, what effects might we hope to witness if it were possible to penetrate to a greater depth in these thermal sources, where the temperature is much higher and the pressure greater, and where therefore the chemical reactions must needs be more energetic!—*Nineteenth Century.*

A NEW UNDERGROUND LAKE.

The Tlemcen *Courier* (Algeria) describes a wonderful discovery recently made at the picturesque cascades of that place. Some miners had blasted an enormous rock near the cascades, and on removal of the *dêbris*, found it had covered a large opening into a cave, the floor of which was covered with water. Constructing a rude raft and providing themselves with candles, the workmen sailed along this underground river, which at a distance of 60 meters was found to merge into a large lake of limpid water. The roof of the cavern was very high and covered with stalactites, the brilliant colors of which sparkled under the light of the candles. Continuing their course, the workmen had at certain places to navigate their craft between the stalactites, which, meeting stalagmites from the bed of the lake, formed enormous columns, which looked as if they had been made expressly to sustain the enormous arches. They thus reached the extremity of the lake, where they noticed a large channel extending toward the south, into which water quietly made its way. This is supposed to be a large fissure which has baffled exploration hitherto at Sebdon, and which connects the cascades with that locality, and thus with the mysterious sources of the Tafna. It is possible that here they have found an immense natural basin, supplied by powerful sources, and sending a part of its waters toward the lake, while the rest goes to Sebdon. The workmen estimated the distance underground traversed by them at three kilometers and the breadth of the lake at two. They brought out with them a quantity of fish, which swarmed round the raft, and which were found to be blind. —*London Times.*

[Continued from Supplement No. 200.]

Translated from *La Correspondance Scientifique.*

THE BEGINNING AND END OF THE WORLDS.

By Camille Flammarion.

IV.

THE RESURRECTION.

The principles of thermodynamics demonstrate that an aerolite which comes from the realms of infinity, to be precipitated into the sun, reaches the latter with the unheard of speed of 627,000 meters (390 miles) during the last second of its fall! The transformation of this motion into heat produces a temperature more than 9,000 times greater than that which would occur from the combustion of a mass of coal equal to that of the aerolite. Whether the aerolite be combustible or not, the combustibility would add almost nothing to the tremendous heat produced by its mechanical shock. If the earth should fall on the sun, she would increase the latter's heat to a sufficient degree to keep up the solar emission for 95 years! And we know how prodigious this emission is, since it is more than *two thousand million* times greater than the solar heat intercepted by the earth, and sufficient to cause to boil 2,900 million cubic myriameters, per hour, of water at the temperature of freezing. Well, then, if the earth should be arrested in her course around the sun, and slowly enough so that the heat caused by such an arrest should not reduce her to vapor, she would fall upon the sun, reaching the latter's surface in 64 days, and her union with the sun, although adding, so to speak, but an atom to the enormous mass of the "star of day," would furnish a quota of 95 years of emission of solar heat. The impact of Jupiter would furnish a quantity of heat equal to that of the solar emission during 32,000 years.

Well, then, when our sun shall be extinct, and roll through space as a dark globe, he will be able, phœnix-like, to arise from his ashes by meeting with another dark globe, and thus will be lighted again the torch of life for new worlds, which the laws of gravitation will detach from the nebula thus formed, as they once detached our present earth and her sisters from the nebula to which they belonged. At this moment the sun is sailing with great swiftness toward the stars of the constellation of Hercules. Every star is animated by an appropriate motion, which transports it, with its system, through immensity. Several of these motions are rectilinear. It is not impossible, then, for two stars to meet together in space; and perhaps that is the secret of the resurrection of worlds.

The earth and the planets will doubtless at this epoch have fallen in the sun. Created simply, says Tyndall, by difference in position of the masses which are attracted, the potential energy of gravitation was the original form of all the energy of the universe. As surely as the weights of a clock descend to their lowest position, from whence they can never remount unless a new energy be communicated to them by some as yet inexhausted source, so, in measure as the ages succeed each other, must the planets fall turn by turn on the sun. When one of them comes within some hundreds of thousands of miles of his surface, if it be still incandescent it must melt and be resolved into vapor through the effect of the radiating heat. Even should the planet, covered with a crust, be cold and externally dark, it would not be able to escape its terrible fate. If it does not become incandescent, like a shooting star, by friction in its passage through the atmosphere, the first grazing against its surface will produce an immense development of light and heat. Finally, either at the first blow, or after two or three bounds, like a cannon ball ricochetting on the surface of the earth or water, the whole mass will be ground up, melted, and reduced to vapor by a crepitation which will produce in a moment several thousand times as much heat as would a mass of burning coal of the same dimensions.

Whatever may be the definite fate of the theory that we have just sketched, it is much to be already able to establish the conditions that would certainly produce a sun, and to have been able to recognize in the force of gravity acting on a dark matter, the source from whence may have been derived the stars of the firmament. For, whether the sun has been produced, and his emission kept up by collision with cosmic masses, or whether the interior heat of the earth is the residue of the heat developed by the impact of cold, dark asteroids, it cannot be doubted that the cause assigned is capable of producing the effects attributed to it.

Perhaps it is a part of the general destiny of the universe that the sun should be directed toward a precise point that he will only reach after his death; and perhaps that is the final cause of the appropriate motion of all the suns in space. But we may at the same time conceive of a second process of destruction and resurrection, of which aerolites, shooting stars, and comets would be proof. From whence come the aerolites? From worlds that have been destroyed. How can a world become broken up in that manner? We do not know, and the fact appears to us even contrary to the laws of gravitation. But what is gravitation itself, in its essence? We do not know that either. Is this force of attraction absolute? Cannot bodies attain certain physical and chemical states in which gravitation is inert? What are these tails of comets that nearly always extend in a direction opposite to the sun? They seem to exhibit the action of a repulsive force, and are, consequently, contrary to gravitation. Well, let us for a moment admit that our globe, in consequence of secular cooling, solidification, and dryness, will one day crack into fissures, and that later on her constituent materials will cease to obey the force of aggregation which keeps them united, then our globe, rocky to her core, would be from that time formed of materials simply juxtaposed, and which would no longer be retained by any central force; like the corpse that, abandoned to the work of destruction, allows each of the molecules composing it the liberty of leaving it for ever in obeying thenceforward new influences. What will happen to this dead planet, to this corpse of the world? The moon's attraction, if it still existed, would alone take charge of the demolition, by producing a tide of pieces of earth, instead of a liquid one. Let the other planetary perturbations be added, and there you have in a few centuries our poor disaggregated globe, its spheroidal form gone, scattering itself imperceptibly along its orbit. There you have the planetary system in fragments. All of that will go to fall pell-mell into the sun. And if such is likewise the final destiny of the sun, here we have this black star, himself disaggregated, and all the constituent particles of the solar system carried off into space to be scattered through the fields of heaven. This dust of worlds will float about in void until, some day, coming into the regions of a new resurrection, attracted by a fecund center, it will again be thrown into the crucibles of creation, and analogous cosmical dusts coming from all parts will unite at this same center to form by their universal fall a new focus of incandescence and creation.

The mathematician and physiologist, Helmholtz, admitting with Kant and Laplace that the nebulous matter of which the solar system was formed was at first of extreme tenuity, determined the quantity of heat that must have been engendered by the condensation to which we owe the existence of the sun, moon, and planets. In taking the specific heat of water for that of the condensing mass, the elevation of temperature produced by the mechanical formation of the sun would have been 28 million degrees! The ulterior condensation of cosmical dusts disseminated throughout space is also amply sufficient, then, for the creation of new worlds.

We may be positively certain, then, that Nature holds in reserve the causes of resurrection as she holds in her hand the causes of destruction. For her time is nothing. An act that requires a hundred thousand years for its accomplishment is as clearly determined and formed as an act which requires but a minute. Absolutely speaking, eternity alone exists, and time is only a relative form of it. As to our human personality and its immortality or its resurrection, a distinction should be made here between matter and spirit. Each of the constituent atoms of our body is indestructible, and constantly traveling from one association to another. Logic leads us to think that our virtual force, our psychic monad, our individual *ego* is equally indestructible, and more justly so. But under what conditions will it exist? Under what forms will it again become incarnate? What were we before birth, and what will become of us after death? Astronomy gives us the first answer worthy of the majesty of nature, and in close correspondence with our innate feelings. But this answer may be only the corollary of a psychological solution. Let philosophers imitate astronomers. Let them work on facts instead of speculating on words, and some day the veil of Isis will be entirely raised for our souls, which are so properly athirst for the truth. Positive science, science alone, will answer: *Life is universal and eternal.*

TIMBER IN BRAZIL.

Within an area of half a square mile, Agassiz counted 117 different kinds of wood, many of them admirably fitted by their hardness, tints, and beautiful grains, for the finest cabinet work. The muira-pinima, or tortoise-shell wood, undoubtedly the most precious wood in the world, is found in large quantity on the tributaries of the upper Amazon, where the water can be most easily applied as motive power. The pao de sangre, the rosewood, the pao de ferro (iron wood), or *Apuleia ferrea*, the various species of jacaranda known to natural history students under the names of *Dalbergia nigra*, *Meehaerium violaceum*, and *Platypodium elegans*, the white and black maraquatiara, the red maçaçauba, the pao santo or holy wood, and the sabuarana– both of which are rivals of the most beautiful walnut—are wasted yearly on the Amazon in amounts ample enough to veneer all the palaces of Europe. Maurice Mauris, the explorer, believes that with the facilities which the Brazilian Government is ready to impart to enterprising industry, the export of these commodities would develop immense profits in the shortest time, while the capital invested need not be enormous. It is only necessary that these woods be introduced into the market to obtain a decided preference over those now most sought after in the two hemispheres. Still richer is the country in timber for the purpose of construction. The acapù (*Vouacapoua Americana*) is most plentifully found there, and often in the most imposing proportions. Mr. Mauris has seen dining tables six feet in width, made wholly out of one piece. This wood, like all its kindred maçaranduba and itauba, or stone wood, furnishes ship timber as durable as teak. The longer these remain in water the stronger and harder they become. The former will compare the more favorably with the teak, inasmuch as it is more compact. A pistol bullet which will pass through an inch board of teak wood, will not penetrate half an inch into a board of acapù. The itauba tree, too, offers many advantages over teak; it branches off naturally into keels and ribs of any size, and is lighter and more resistant.

A RARE IRISH ORCHID

Visitors to the south-west of Ireland, on their way from Killarney to Cork by Glengariff, pass along the upper or inland portion of Bantry Bay. Generally content with the beauties of the scenery surrounding them, they seldom explore the remote recesses of this magnificent arm of the Atlantic. Some 24 miles from Glengariff, on the northern side of the bay, lies the picturesque village of Castletown, protected from the south-westerly gales by a long chain of hills some 900 ft. high, detached from the main land, called Bear Island. In the channel known as Bear Haven our fleet often rides securely at anchor. Here in a few sunny, sheltered spots, by the border of the sea, in little seaside meadows, there are now to be found in full flower specimens of a deliciously fragrant orchid—the sweet-scented lady's tresses. Each plant bears a stout spike of flowers of a cream-white color arranged in three series or rows, each flower being at least three times as large as those of the autumnal lady's tresses so commonly to be met with in the dry pastures of the south of England and Ireland at this season. By botanists it is called *Spiranthes Romanzoviana.* Sir Joseph Hooker once referred it to *S. cernua*, a species common in the United States, and till quite recently confounded with it by the American botanists. The chief charm or attraction in this little orchid is, however, its very peculiar geographical distribution. Except over a few acres near Castletown looking towards the south-west, it is not to be met elsewhere in the Old World. Unlike some of the rarer west of Ireland plants, it does not occur on the west coasts of Spain or Portugal; and yet cross over the Atlantic and it is to be met with in New York and thence on to the very borders of the Pacific.—*London Times.*

© 1879 SCIENTIFIC AMERICAN, INC.